Next Generation Connectivity

The Berkman Center for Internet and Society

Evaluation and perspectives from Liberty Global Europe

Context and objective of this brief

The deployment of Next Generation Access (NGA) networks has become a priority and a key approach for global policy makers. Regulators and governments are still in the process of formulating their approach on how to stimulate the transition and some market participants are eagerly awaiting those decisions before making major investments.

Multiple studies are being conducted to help market players think through the required trade-offs to work towards the shared objectives. In October 2009 a report was published by Liberty Global prepared by Bain & Company. In the same month another report was released by The Berkman Center for Internet and Society.

Liberty Global's Policy paper is titled: *"Next Generation Competition".* The report focuses on the European situation and concludes that there is by no means a "one size fits all" solution. Each market has to be reviewed in its own context. The best consumer outcomes have been observed where there is competition among access infrastructure providers. There, high-speed broadband has followed a pattern of continuous, counter-cyclical waves of innovation and investments.

The Berkman Center's report is titled "*Next Generation Connectivity".* This paper looks into case studies across the world, many of the examples from across Europe, and seeks to draw lessons for the US situation. One of the main conclusions of the report is that, as open access regulation in Broadband has played a strong role in driving positive competitive outcomes, this could again be applied to migration to next generation connectivity.

Based on Liberty Global's strong local presence in multiple European markets and its recent in-depth study of the key drivers of NGA development in these markets, we would like to provide some further background to in particular the European examples that drive the main conclusion of the Berkman report.

Conclusions

- **A single 'one-size-fits-all' recommendation is not credible in respect of different market starting points and different investment and competition dynamics**
- **Open access has been outperformed by Infrastructure Competition in the 1st generation broadband market in Europe**
- **Leveraging open access experience from 1st generation broadband to the Next Generation Connectivity market is a big leap of faith**
- **There is no evidence yet to conclude that open access is leading to Next Generation Connectivity on any significant scale**
- **European experience generally shows that shift towards Next Generation Connectivity will likely be gradual and granular**
- **Country examples inappropriately attribute broadband performance solely to open access with no appreciation of the impact of cable infrastructure competition**

- **A single 'one-size-fits-all' recommendation is not credible in respect of different market starting points and different investment and competition dynamics**

We challenge the Berkman report's implied assumption that a 'one-size-fits-all' policy approach based on 'open access' could be justified on the basis of selected individual country situations in Europe. Setting to one side some factual errors and inconsistencies in the country analyses -which we address elsewhere in this submission-, we believe that benchmarking the US against individual countries that are much smaller in scale, have different legacy market characteristics and different regulatory histories, makes a like-for-like comparison difficult and any conclusions based thereon could be misleading. Benchmarking the US regulatory and market developments against the EU as a whole in our view would be a more credible analytical approach, and one more likely to yield sustainable conclusions. In both the EU and the US, differences in development of regions can be observed and these are reflected in differentiated regulatory approaches tailored to address specific local concerns. The different starting points of market development toward next generation connectivity impact on the key performance indicators identified: coverage; speed; price.

Generally, markets within the EU -and we assume this applies for the different regions in the US- could be divided into:

(i) *Dual infrastructure markets with advanced levels of competition*

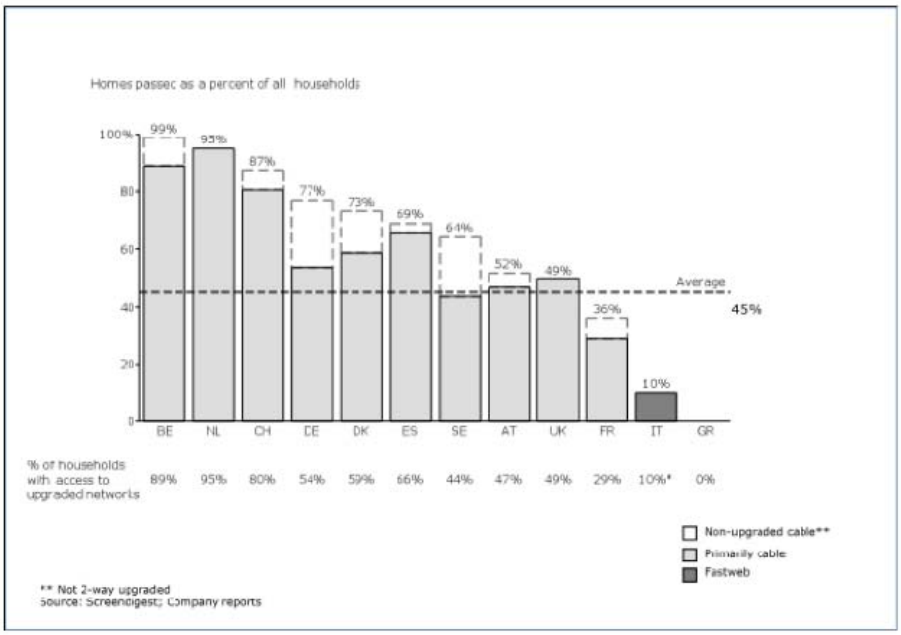
In these markets typically telecom and cable operators are increasingly competing in each others' traditional markets, spurring momentum for the upgrade of fixed networks and gradually provide higher broadband speeds, in line with evolving consumer demand.

(ii) *Single infrastructure dominated markets*

These markets have seen limited roll-out of cable and other alternative infrastructures for historical and economic reasons and rely fully on a the telecommunications incumbent's copper access infrastructure for broadband and fixed voice services. Typically, these markets lack the competitive dynamic between infrastructure owners with the incentives of first mover advantage and operate with heavier regulations. In some markets, these factors have slowed down investments in innovation and network upgrades, triggering the need for more creative break-out solutions. Main examples include Greece and Italy.

(iii) Rural or remote areas *with unfavourable economics for upgradable infrastructure*

These markets are typically characterised by a very low density and relatively high build-out costs, resulting in unattractive business cases with very long paybacks, unable to deliver reasonable investor returns. For these markets, wireless technologies tend to be relative promising alternatives to fixed line competing infrastructures.

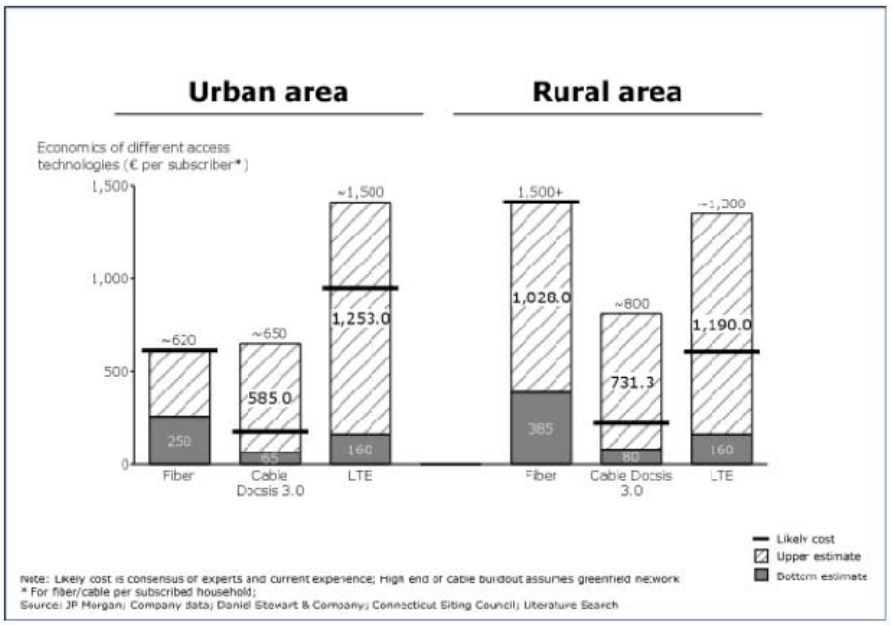


Different markets have different starting positions

A one-size-fits-all recommendation also neglects that market players have different starting positions regarding migration of their 1st generation broadband networks or services toward a next generation status. Therefore, the choice of regulatory instruments by national regulators will impact investment decisions differently. To cope with this complexity, national regulatory policy is often tailored to

specific competitive challenges reflecting, e.g. varying levels of technological complexity, legacy systems and upgrade costs.

- *Incumbents/former PPT*: The traditional PSTN network gradually evolved through ISDN to ADSL and can be further upgraded by migrating to VDSL and FTTC/H based on PON and GPON technologies. The required investments for the latter upgrades however are significant, requiring demonstrable consumer demand and willingness to pay to justify the business case
- *Cable operators*: The introduction of EuroDOCSIS 3.0 enables cable operators to upgrade their network end offer down- and upstream speeds of up to 400 Mbit/s. Cable networks are economically advantaged versus traditional copper since they allow for a more modular upgrade, which make investments less risky ('invest as you grow')
- *Challengers*: wireless access providers are technically challenged in achieving the same bandwidth performance levels as their wireline counterparts with the upgrade to NGA; The practical deployment is likely to remain below 20 Mbit/s, with upgrade costs to LTE/next generation wireless networks significantly above cable and fibre investment levels



Different assets and upgrade economics

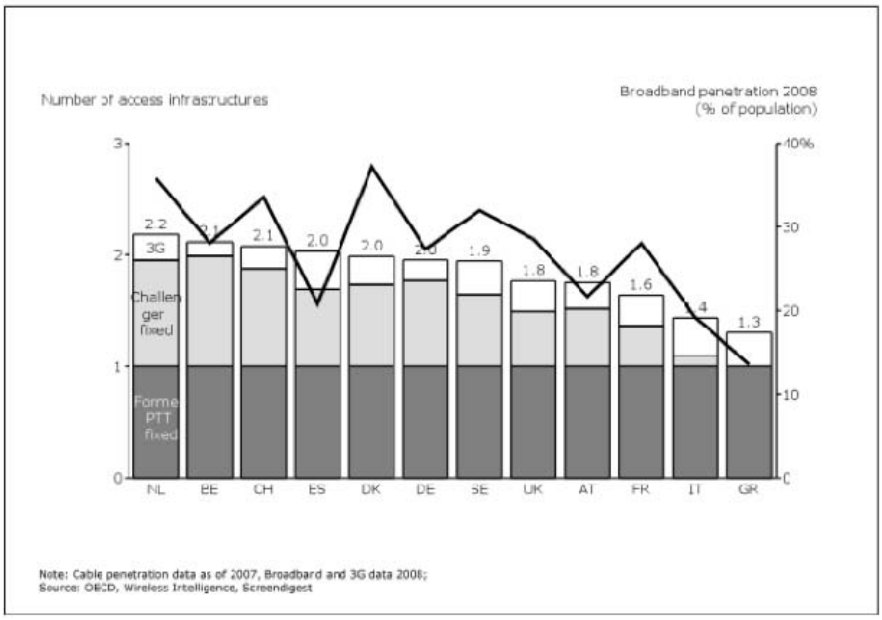
The different starting points of markets and market players towards next generation connectivity are currently addressed by differentiated regulatory approaches that are tailored to address specific local competitive concerns, as can be observed in Europe.

- **Open access has been outperformed by Infrastructure Competition in the 1st generation broadband market in Europe**

We challenge the Berkman report's view that 'open access' alone has produced compelling competitive results and consumer surplus in the 1st generation transition from dial-up to broadband "in most of the high performing countries". The report suggests that market entry of facilities-based competitors making use of open access, in addition to competition between incumbents and cable networks, is required to bring about a consumer surplus consisting of high speeds against lowest prices. This view appears based on the observation that "inter-modal" competition between one telecommunications incumbent and one cable operator has led to the highest prices for the lowest speeds in the US and Canada.

By contrast, the experience with Infrastructure Competition in Europe is substantially different casting further doubt as to the sustainability of Berkman's conclusion on the benefits of an open access regime in terms of stimulating broadband consumption and the shortcomings of infrastructure competition

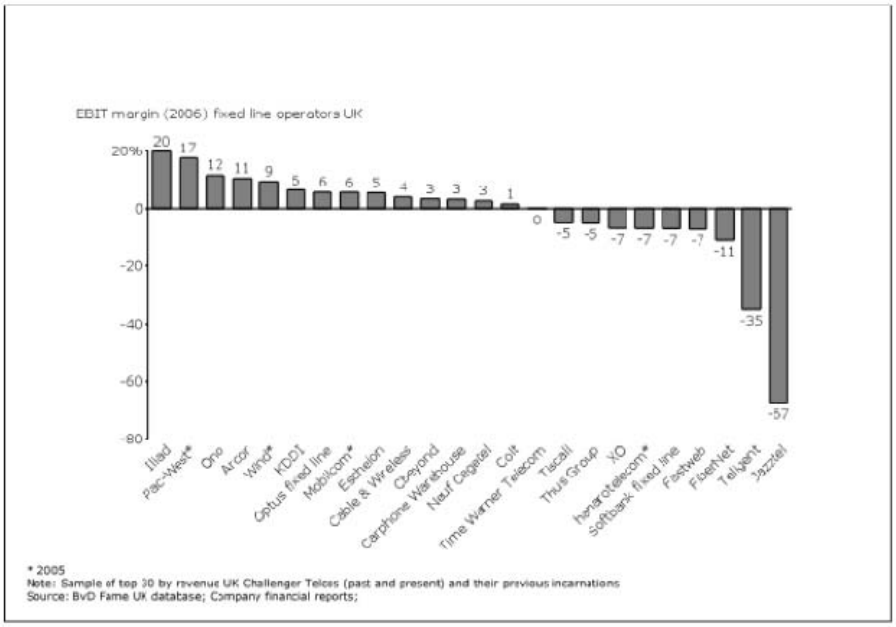
Notwithstanding the diverging level of facilities-based competition, it is generally accepted fact that it is the existence of at least one challenger network, mainly cable, which has driven investments in broadband innovation and broadband coverage.



Countries with more two or more competing infrastructures have higher broadband penetration

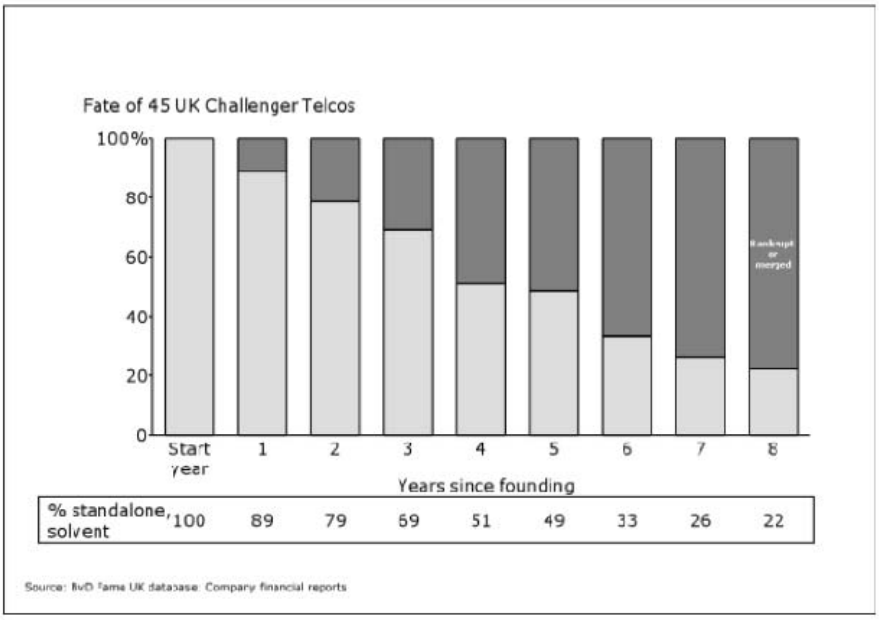
Open access has initially led to promising results, with multiple new entrants gaining market share, price levels declining and new service propositions launched. However, in markets where already two or more infrastructure providers were already effectively competing for the same customer base, open access eventually led to a myriad of failures of financially unsustainable players that were acquired by

incumbents. As the service provider business model is essentially an "arbitrage" based business, leveraging the price differences between retail and interconnection prices became increasingly financially challenging as, over time margins became slimmer, In turn this made it more difficult for new entrant service providers to attract new customers and survive as a competitor purely on the basis of price. Therefore, whilst they succeeded in taking away market share from former PTTs, they have been generally less profitable and prone to consolidation.



UK example: Fixed-line challengers economically not sustainable

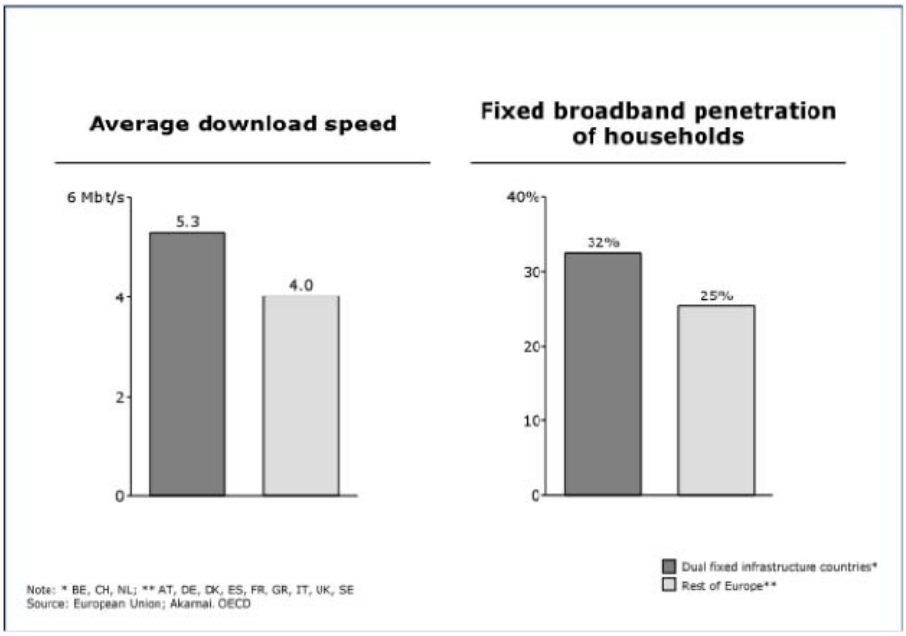
Facilities-based service competition is generally viewed as indeed leading to lower retail prices but only in the short term. This model of competition is also considered not to lead to substantial technological or service innovation as new entrants seldom climbed the ladder of investment, and simply resold incumbents' products or sold other wholesale products defined by the incumbent. Evidence also shows that the number of facilities-based new entrants (e.g. resellers) was drastically reduced over a relatively short period of time: successful new entrants were either consolidated by the incumbents, or squeezed out of the market by delaying tactics of incumbents as many wholesale propositions proved unviable and had to be resolved by too lengthy regulatory disputes.



UK example: Short lifecycle for challenger fixed-line telcos in the UK

The experience of open access regulation in Europe has therefore has not lead to sustainable market structures in the 1st generation broadband market in Europe. On the contrary, there is a wealth of evidence which demonstrates that it is precisely the competitive pressure of challenger networks, mainly cable, wich drives broadband investment and service innovation leading to higher speeds and higher broadband penetration. This is because incumbents were forced to accelerate roll-out of their competing broadband technology on a nation-wide scale in order to reduce churn to cable.

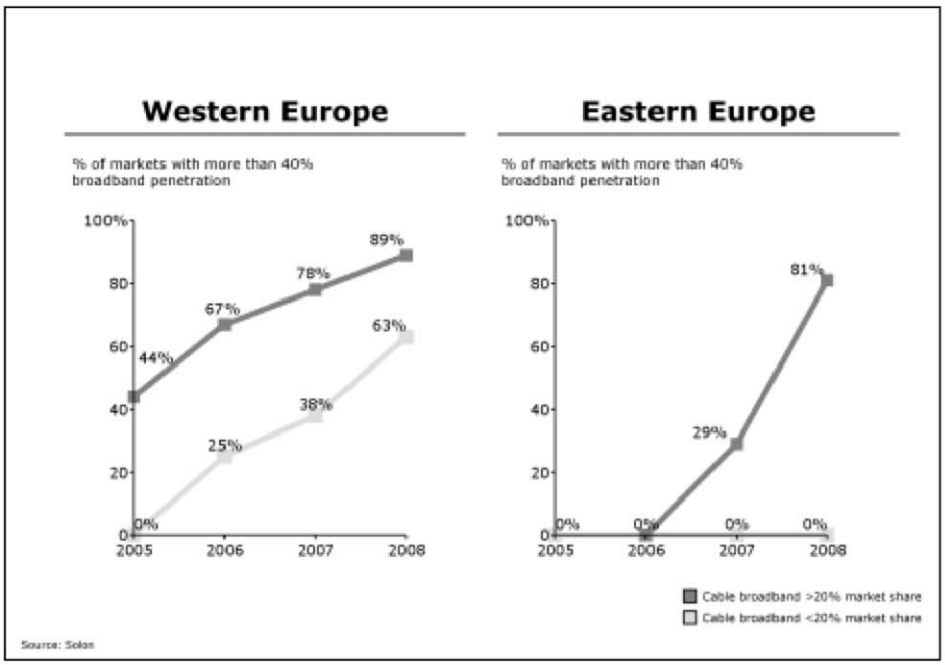
In countries like the Netherlands, Belgium and Switzerland, where two competing infrastructures exist on a nationwide scale, scores on the Berkman report's KPIs are higher than in the rest of Europe. Consumers on average experience broadband speeds of 5.3 Mbit/s (versus 4.0 Mbit/s in other W-European countries) and broadband penetration currently is at 32% of the population (versus 25% in other W-European countries).



Countries with higher number of access infrastructures, score higher average download speed and fixed broadband penetration

According to Solon[1], Cable-driven broadband markets are at least two years ahead of their DSL/LLU driven counterparts. Broadband penetration in markets with infrastructure competition, driven by cable, is not only higher than in markets with limited infrastructure competition, it also reaches *higher penetration* considerably *earlier*. Structural differences between DSL and cable networks and full infrastructure control generally enable Cable operators to provide *better price-performance* ratios than DSL providers – especially compared to open access based operators, like LLU operators that have to pay for "last mile" access.

[1] Solon: *"Cable in Europe: DELIVERING THE FUTURE TODAY"*, October 2009



Solon report: markets with more than 40% broadband penetration

- **Leveraging open access experiences from 1st generation broadband to the Next Generation Connectivity market is a big leap of faith**

Considering the output of open access policies in the 1st transition to broadband as being predominantly "positive", is in our view, highly questionable based on evidence that 'open access' mostly led to unsustainable competitive market structures. Even in those countries or regions where 'open access' initially may have successfully forced the 1st generation broadband market open for competition, applying the same logic to the investment needed to migrate to next generation broadband markets is entirely misplaced, in particular where it can be shown that Infrastructure Competition is outperforming open access based competition. We therefore challenge the Berkman report's assessment that open access policies should play "a core role" in subsequent planning for the next generation transition toward next generation connectivity is simply unsustainable in light of experiences to date in Europe..

The experience in Europe is that high-performance countries pursue next generation broadband strategies that balance an open access approach with infrastructure competition, where challenger networks are present. These challenger networks are either fully independent alternative infrastructures like cable, or facilities-based competitors that have successfully invested in their own infrastructure and have become independent on incumbents' access products. European Telecoms Commissioner Ms Vivian Reding acknowledges that (…)*a gradual move from service-based competition to infrastructure-based competition can be observed in many countries* **(..)** This will lead

to more infrastructure-based competition over time which is to be welcomed as a more resilient and independent way to compete.(..).[2]

There is a significant school of thought in Europe that argues that access regulation actively inhibits infrastructure investment by new entrants reaching their full potential, the ultimate goal of facilities-based competition based on the 'ladder of investment' doctrine[3].

A recent study[4] for the European Competitive Telecommunication Association calls on regulators to do more than they did with regard to unbundling of the local loop (ULL) to shorten the gap between imposing NGA related remedies and the actual availability of the relevant wholesale services. In the case of ULL, availability competitively priced products often amounted to several years. Given the relevance of first-mover advantages similar gaps in NGA wholesale products could endanger the (already limited) potential of facilities-based network replicability to an even greater degree.

Experiences of open access policy in the 1st generation broadband environment may in addition not be relevant in a next generation connectivity environment for technical and economic reasons: for example, certain forms of open access would be uneconomical (e.g. fibre unbundling) to carry over. Moreover, in markets where open access has indeed led to facility-based competitors investing in own, new infrastructures and becoming less, or not, dependent on incumbent wholesale access products, it would only be logical to shift emphasis from forced access to infrastructure competition.

Other studies[5] argue that access regulation has under-delivered to the equivalent of €18.1 billion, 8.4 percent of total European telecom investment. Instead of new entrants committing to their own infrastructure investment, in the main service-based competition by new entrants over the incumbent's infrastructure was achieved by access regulation, which led to lower prices and greater choice of providers only in the shorter term.

The retail price softening effect of open access regulation on incumbent networks also negatively impacts the potential of Infrastructure Competition. Whilst only indirectly affected, lower retail broadband price levels reduce profitability and return on investment by cable operators in network upgrades. In addition, inappropriately priced, below-cost, wholesale access prices are detrimental to cable operators past and future investments. In order to promote efficient investment in infrastructure a fair access pricing regime, which reflects investment risk but which discourages wholesale costs detrimental to infrastructure investment already made, or about to be made is required.

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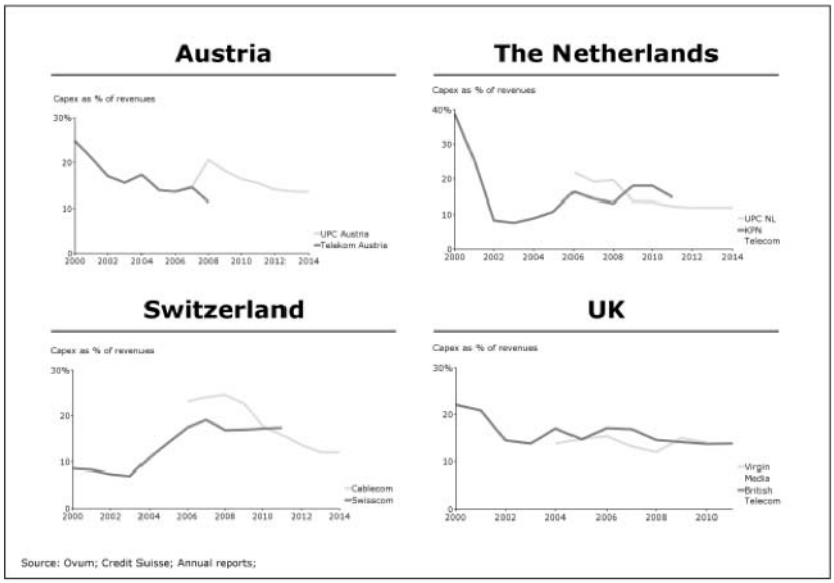
[2] ECTA Annual Conference 2008, Speech by Ms Reding
[3] Also for the US, no empirical evidence has been found to support the investment ladder doctrine: Hazlett, T. W. and C. Bazelon (2005), "*Regulated Unbundling of Telecommunications Networks: A Stepping Stone to Facilities-Based Competition?*" 33rd Research Conference on Communications, Information and Internet Policy, Alexandria, VA.
[4] WIK-Consult (2008), "*The Economics of Next Generation Access*"
[5] European School of Management & Technology: White Paper '*Analyzing the relationship between regulation and investment in the telecom sector'*, 2008

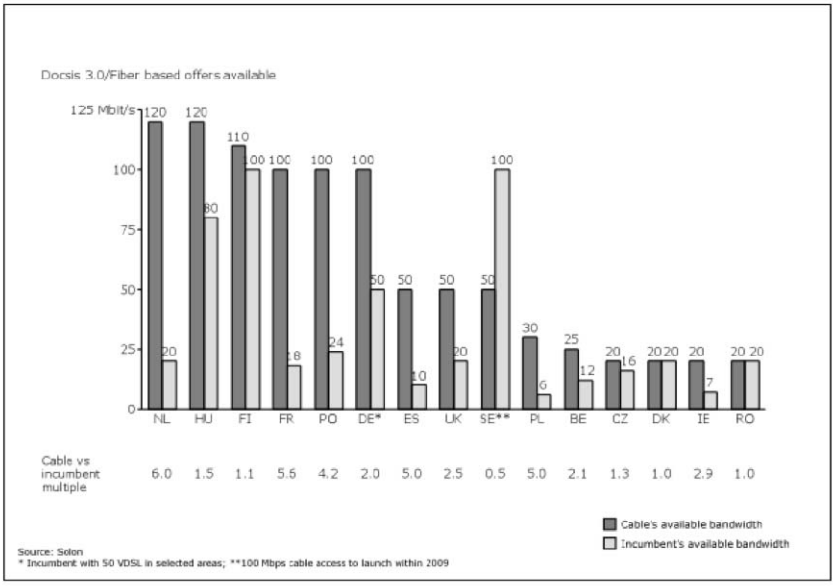
Investment by incumbent providers in Europe remained roughly the same as a result of open access regulation[6]. Evidence todate shows that the evolution toward high-speed broadband has followed a pattern of continuous, counter-cyclical waves of innovation and investments. That is especially true where there is competition among access infrastructure providers, as one player's progress in network upgrades to higher speeds usually triggers competitive responses from other players. This could be taken to mean that open access regulation only plays less of a role in investment decisions by the incumbent than the prospect of infrastructure competition. This pattern of investment is only likely to intensify, as the economics of NGA upgrades are more challenging, and are unlikely to occur rapidly without the pressure of market share loss flowing from superior technology investments by challengers.



Countercyclical investment patterns of incumbent and cable in countries have characterized historical migration towards 2nd generation broadband

[6] European School of Management & Technology: White Paper '*Analyzing the relationship between regulation and investment in the telecom sector*', 2008

Solon: Available bandwidth



We therefore believe that open access regulation only plays a minor role in investment upgrade decisions by the incumbent in comparison with the prospect of infrastructure competition. If past experiences in the 1st transition to broadband are anything to go by, we would argue that Infrastructure Competition and preserving natural market dynamics following sound investment cases are the way forward to foster a sustainable migration towards next generation connectivity on a meaningful scale.

- **There is no evidence yet to conclude that open access is leading to Next Generation Connectivity on any significant scale**

We challenge some of the Berkman report's conclusions derived from case studies of currently existing next generation open access regimes in Europe. None of the case studies deliver compelling evidence that open access has yet led to investment in, or coverage of, FTTx networks on a meaningful scale. We therefore cannot support the assessment that open access based regulatory models are the leading driver of wide spread investment in next generation connectivity.

According to IDATE[7], the inventory of FTTH/B deployments in Europe at the end of 2008 reveals that the FTTH market in Europe continues to grow in terms of homes passed (11.2 million in EU27 + Norway, Iceland, Switzerland & Andorra). But, with only around 1.7 million FTTH/B subscribers at the end of 2008, Europe is still lagging behind the US and Japan (nearly 15 million FTTH/B subscribers expected at the end of 2008). Municipalities and Power Utilities are still the main initiators of FTTH/B projects in 2008, with 58.5%, in sharp contrast to the incumbents who count for just 9.8% of all players involved in FTTH/B projects. The principal European incumbents -France Telecom,

[7] IDATE, *"FTTH European Panorama",* FTTH Council Europe Conference, 2009

Telefonica, Telecom Italia, Belgacom, KPN, Swisscom- have merely *announced* plans to deploy FTTH/B but there is little tangible economic commitment to making these investments. Other incumbents such as BT and Deutsche Telekom in the main rely on ADSL+2 and VDSL based technologies as the core of their NGA architectures.

The European Telecommunications Network Operators' Association still cautions[8] the European Commission to adopt next generation open access regulations that would fail to allow an adequate sharing of the investment risks between incumbent and access seeker. More generally, the European incumbents argued that the continuation of open access regulation to their next generation networks is delaying important investment decisions.

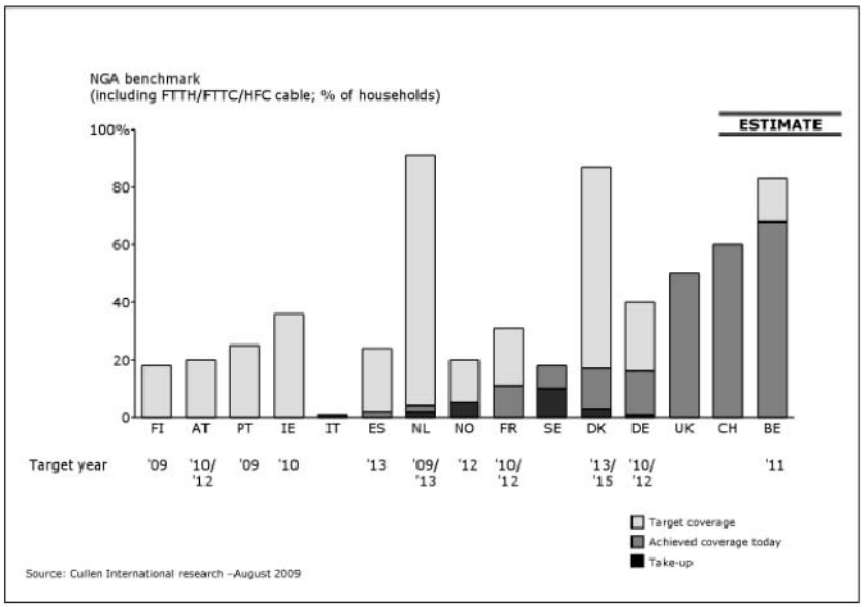
We would further caution against viewing public private partnerships (PPP) as a model to drive significant FTTH/B coverage. The Amsterdam Citynet project has been quoted as an example of an open access based PPP where government investment is permitted if it can be shown to be on equal terms to what a market investor could have undertaken. Without going into the merits of the case on whether the Citynet's business case was based on rational assumptions from the start, regarding, inter alia, (speed of) penetration levels, evidence shows that the Citynet project significantly failed to achieve its own projections: of the 43.000 homes passed, reportedly[9] less than 9.000 homes have been connected to date with just 3.000 active users since the start of the project in 2006. Meanwhile the share of the public partners (the Amsterdam Municipality and the Housing Associations) has been reduced as the incumbent KPN formed a JV with Reggefibre, the only remaining private partner (ING real-estate bank, one of the former private parties withdrew from the project) and announced to take a joined share in the Citynet project of 70%.

Finally, functional separation of the incumbent's wholesale and retail operations has been highlighted as a way forward to "*addressing complexities of applying open access policy to next generation infrastructure*", an approach that was pioneered in the UK with 'Openreach'. Also here, no evidence yet can be derived from the present situation on the UK market that this has lead to sustainable market structures or incentives for fibre investment at a significant scale. Sweden has applied functional separation to the copper-based network but no specific measures have been adopted by the Swedish regulator to extend the scope to fibre-based next generation networks.

European experience generally shows that shift towards next generation connectivity will likely be gradual and granular

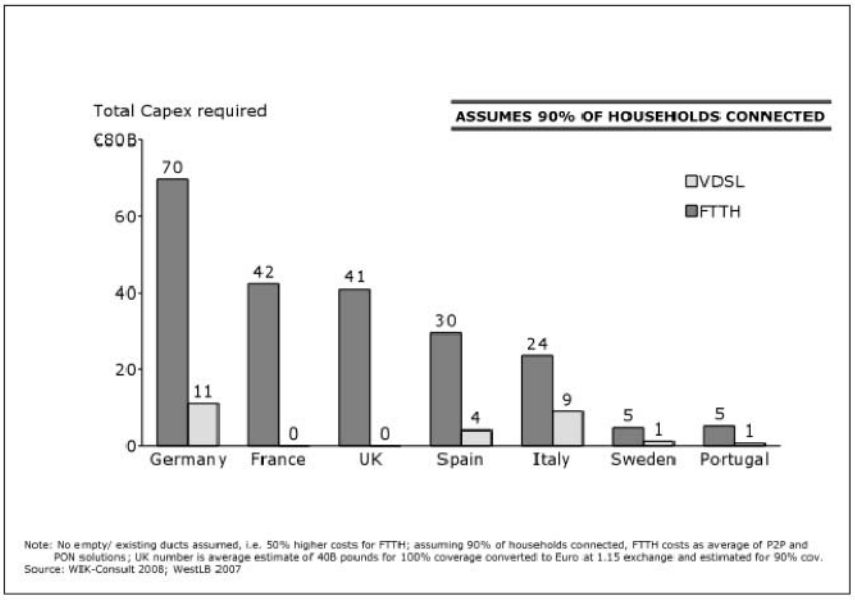
[8] ETNO (2008) *ETNO Reflection Document in response to the Commission Recommendation on regulated access to Next Generation Access Networks (NGA)*
[9] http://www.mdweekly.nl/904877/glasvezel-is-nog-geen-groot-succes-in-amsterdam

In our experience as long-standing operator of cable infrastructures throughout Europe, we observe that different markets follow different transition paths reflecting specific 1st generation starting points as the basis to achieve their stated next generation connectivity ambitions. Regulation is playing different roles in shaping competition and stimulating investment, different per country - even different per region within countries - depending on the legacy technology or regulatory history, in addition to differences in macro-economic factors such as GDP. It is therefore unrealistic that a single regulatory approach, be it open access or infrastructure competition, could be the sole basis for next generation connectivity policy of any country.



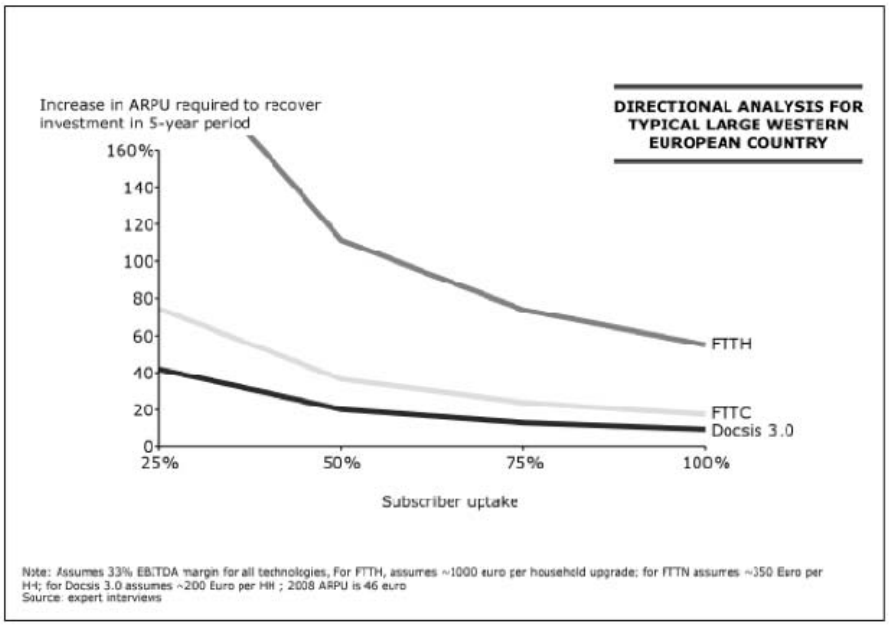
Countries differ in advancement with upgrade to NGA

Detailed discussions are still ongoing at EU- and domestic Member State level as to the appropriate balance between a continuation of some form of open access model and the need to preserve investment incentives and spreading risk amongst incumbents and facilities-based operations. The fact that the discussion on the feasibility of open access in an next generation environment is so extensive and long, demonstrates that the next generation connectivity market has significant new economic challenges and raises new competitive issues particularly also related to access technologies. It is as such difficult to see how 1st generation open access policies could simply and effectively be transposed to a next generation context.



NGA fundamentally different: Significant investment required for NGA build-out

Since the business case for upgrading networks to NGA is already challenging (requiring significant ARPU and customer uptake based on a payback period of 5 years) the prevailing and future regulatory regime has a critical impact on the attractiveness of a given NGA investment. In markets where multiple infrastructure providers create a healthy competitive dynamic, uncertainty around returns on significant investments in NGA upgrades created by the option of open access obligations will likely negatively impact the speed of transition. In markets where there is no such competition, open access may well remain one of the tools at hand to infuse more intense competition and incentivize innovation and investment.



Business case challenging (even without regulation), with significant ARPU and subscriber uptake required for payback within 5 year period

So far, there has not been, nor is there likely to be, a big leap forward to NGA in any European market. Neither will "NGA" mark the end of innovation. To effectively stimulate continuous innovation and network expansion, it is critical for markets to preserve long-term competition amongst infrastructure players.

We believe that, just like migration to 1st generation broadband in markets with competition among infrastructure providers followed a pattern of continuous, counter-cyclical waves of innovation and investment, transition towards NGA is expected likely to evolve along similar lines. Most fixed infrastructures today can, in fact, be upgraded to NGA with the right investment incentives. However, the business case for private operators will be highly challenging as it remains uncertain how much consumers are willing to pay for higher bandwidth and broadband margins generally tend to decline. As a result, broadband providers so far appear to be more inclined to follow a natural pace of experimentation and adaptation to consumer demand, rather than invest in major system-wide network upgrades. A sustainable degree of infrastructure access competition is more likely to make Next Generation Connectivity available efficiently and more in line with demand than 'top-down' target setting.

In conclusion, we do harbour strong concerns that much of Berkman's analysis of the benefits of open access regulatory policy are not robust nor sustainable in light of econometric evidence from across Europe. Indeed, we would question if Chairman Genaschowski's desire for 'enlightened, data-driven decision-making' is well served by the Berkman study, and as such, whether its conclusions are a credible basis for public policy reflections by the FCC.

Regulators and governments in Europe are still in the process of formulating their regulatory approach on how to stimulate the transition toward next generation connectivity and market participants, particularly incumbents, appear to be eagerly awaiting those decisions before committing to major investments. There is nevertheless market evidence to show that, regardless of any regulatory uncertainty, incumbents are following suit with their NGA investments in areas where cable, based on deployment of Eurodocsis 3.0 technology, outperforms incumbents in broadband speeds and digital television applications (HDTV, VOD).

What is certain is that the investment case for all present infrastructure operators, fixed or wireless, is challenging. In order to avoid a next generation internet bubble and rather to foster a sustainable migration of current broadband to next generation, a policy environment should be created that allows investments be market- & competition driven and based on sound economics reflecting genuine consumer demand and a willingness to pay. Any form of regulatory intervention that disrupts this market-driven cycle of investment, be it undue access regulations that do not sufficiently reward

investment risk or undue state subsidization, may lead to stagnation or delay in market development towards next generation access networks or subsequent future generation networks.

The drivers of innovation towards next generation connectivity in the telecommunications sector in Europe have been analysed in greater detail in a recent public policy report commissioned by Liberty Global: '***Next Generation Competition***'[10] (October 2009). We believe that this report offers interesting insights into the economic drivers of sustainable next generation broadband market development, which are also relevant in a US context.

Liberty Global submits the full report together with this paper.

[10] '*Next Generation Competition – Driving Innovation in Telecommunications*', Bain & Company. Published under Liberty Global's Policy Series, October 2009. Download available from: http://www.lgi.com/ir_public_policy.html
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Annex: Local perspectives on the Individual Country Case studies

Fundamental to the paper "Next Generation Connectivity" is the use of extensive (European) benchmarks. For each country, an assessment of the main policies and practices was conducted and compared to the key performance indicators (penetration, capacity and price). Subsequently, key lessons are extracted and translated into potential implications for the US.

We analysed, together with local country experts, some of the key European case studies from which the Berkman report derives its endorsements of open access as the guiding principle for next generation connectivity policy.

In feedback from these experts, as well as our own analysis, two observations can be made that apply across several of the key country analyses:

- Positive in-country developments were inappropriately attributed to open access alone
- Appreciation of the impact of cable infrastructure competition on broadband KPIs and investment decisions of the incumbent is generally lacking or even overlooked .

We also challenge the conclusion that the country cases would always support the report's pro-open access recommendations and sometimes contain factual mistakes[11]. In addition, the definition of 'open access' was both vague and inconsistently used throughout, further blurring the report's assessment of its contribution to broadband consumption and/or connectivity.

UK

The Berkman report suggests that introduction of functional separation was the solution to unlock LLU-based investment, innovation and competition.
However, UK country experts, by contrast, state that LLU based competition developed one year before the introduction of functional separation (2005), triggered by:

- a 70% reduction in LLU charges offered by BT in 2004
- the establishment in 2004 of the 'Office of the Telecoms Adjudicator', an independent body acting as arbitrator and facilitator with the aim to develop better LLU products and to avoid lengthy regulatory disputes.

It is believed that those two factors drove LLU to develop at scale and not the introduction of functional separation one year later.

[11] As an example, it is stated that the Slovak Republic "has been in the process of passing unbundling requirements for over two years, but has not yet done so". The non-availability of LLU is linked to the Slovak Republic's weak performance in broadband i.e. customers paying high prices for low speeds. This is incorrect. As the Slovak Republic is an EU Member State, it has to comply with EU directives and consequently, LLU has been implemented in the Slovak Republic by the 2003 Electronic Communications Law.

The Berkman report rightly concedes that any conclusion of LLU (functional separation driven or not) driving investment in next generation connectivity is "a matter of speculation". Evidence from the market firmly and undisputedly underpins this view.
In addition, the country annex overlooks the contribution infrastructure competition from cable played in accelerating next generation broadband investment:

- The report's description of cable competition does not entirely do justice to factual developments that took place. First, the report states that a deal between top cable challenger Virgin Media and Cable&Wireless to provide alternative broadband services over Cable&Wireless facilities "collapsed". Virgin Media however did take on Cable&Wireless wholesale facilities to offer competing broadband products to BT outside Virgin Media's original footprint and therefore increased infrastructure competition in the UK on a meaningful scale.
- It is probably fair to say that Virgin Media's launch of Eurodocsis 3.0-based products in 2007, which places it in first position in terms of speed leadership position on the UK broadband market with a 50MB offering required BT to follow suit with its next generation broadband investment. BT would have no need to make such investment in response to LLU-based operators, who's current top speed is in line with BT's own top product and does not exceed 20MB[12].

Berkman further suggests that functional separation of the incumbent's wholesale and retail operations would be a way to address "complexities of applying open access policy to next generation infrastructure" and that this is implemented by a number of high performing countries in Europe, following the example of 'Openreach' in the UK.

A closer examination of the practical experiences with functional separation in the case of the UK, is likely to lead, however, to the opposite finding. Initially, the functional separation increased competition in the broadband retail market. Multiple competitors took advantage of the opportunity and began offering their own services using the Openreach infrastructure. Others combined the Openreach local loop infrastructure with investments in their own equipment ("DSLAMs" and backhaul lines) installed in the local exchanges. In some exchanges, there were as many as six or more service providers delivering broadband services. The number of service providers grew to more than 400 in the UK.

However, the fixed costs of the equipment and other operating costs then encouraged competitive service providers to price aggressively to gain share. In addition, some service providers offered retail prices below wholesale cost, as part of a wider bundle of services. For example, BSkyB has done this

[12] See: http://www.thinkbroadband.com/isps.html

to gain share of broadband and protect its core pay TV business. The result was that many of the small service providers proved unsustainable, and industry consolidation amongst retail service providers followed.

In terms of outcomes, what is clear is that the change initially stimulated retail competition, lowered prices, and supported increased penetration of broadband into UK homes. However, not all consumers have benefited in the same way.

- Those in dense urban areas benefited from increased choice and lower prices.
- Those in more remote areas, where the case for investment by service providers was lower, did not. Those in remote areas also did not have access to the same broadband speeds due to longer distances from exchanges.
- In addition, the fierce competition (including against cable, which also covers only the densest areas) and eventual consolidation amongst the winners, has left the market highly consolidated, with overbuilt exchanges in the densest areas, and a destruction of value amongst the losers.
- BT itself has ended up with the lowest share of retail broadband compared with any other former incumbent telecom operator.

One could argue that open access has fundamentally undermined investment in NGA, as the incumbent has not sufficient market share or ROI to be able to afford investment in next generation networks. Moreover, given the regulator's failure to appreciate this, the regulator has not made assurances to the incumbent operator or any other operator that if they do undertake the investment they will not be exposed to open access regulation on such an investment, putting ROI of major new investments at risk.

Germany

As a general observation, the German country annex on relatively out-of-date market data (many sources from 2007). As a result, there are several examples of incorrect market shares or growth numbers that give an incorrect and incomplete picture of the current situation.
In particular, the role of infrastructure competition in the migration towards 1st generation broadband is inadequately covered. Specifically, the description of cable does not reflect current market reality.

- *"Germany was not able to convert its large installed cable plant, passing over two-thirds of homes, into a substantial source of competition. (..) Germany now has no cable-based broadband competitors of significance*".

Whilst in the recent past cable's growth was hampered by the separation between Level 4 and Level 3, in which larger cable operators (level 3) did not have end customer access and had smaller ARPU per household, making significant network investment more challenging. Today, cable has become the main competitor for Deutsche Telekom (DT) in broadband (30% of all new broadband customers select cable, 48% DT and the remaining 20% spread amongst the other smaller providers). With the introduction of Eurodocsis 3.0, cable's share is even more likely to increase.

The competitive threat of cable in Germany has led DT to invest significantly into VDSL in particular in areas where they are actually facing cable competition. However, DT also appears reluctant to invest on a larger scale in fibre without a clear view on future regulatory environment. DT is following a more opportunistic, fragmented ' upgrade' approach e.g DT recently upgraded the 50 largest cities to VDSL services and recently opened its VDSL network for resale (though no bit stream offer). DT is furthermore cooperating with city carriers (private entities) to set-up local FttH networks. This contradicts the report's finding that "*Germany has no significant fiber development either*".

The German experience with resale was successful right after enforcement of regulation (3.5 million broadband connections through a reseller deal), Today – besides ISP 1-to-1 From United - there is no credible and sizeable reseller present in the market. After significant consolidation and reaching economies of scale, most entrants migrated to facility-based operations. It could therefore be argued that, whilst some sort of access regulation after liberalization was justified to fuel competition, today, multiple infrastructures are effectively competing for the same customer base. Hence, there is limited rationale for an open access regulation to incentivize migration to next generation broadband.

Switzerland

The Berkman report acknowledges the role played by cable competition on the incumbent's decisions to upgrade its broadband offerings and to invest in fibre. Then, however, the report states that despite such "signs of viable infrastructure competition", Swiss regulators have also pursued open access policies, as if without it, competition would not have sufficiently developed. This view seems however based on a reference to a Federal Council document, dated 2003(!) on the state of competition in the Swiss telecoms market. This neglects the significant development of competition in Switzerland since 2003 that would likely have led to a different perspective on the feasibility of open access in a next generation broadband scenario. Having achieved 40% coverage of Eurodocsis 3.0 within the first three months, cable's pressure on Swisscom is set to increase with 90% coverage by end 2010 looking viable. In addition, utilities are entering the market rolling out local fibre networks, which increased competition.

LLU was effectively introduced late in Switzerland due to the fact that the 1998 Telecoms Act provided insufficient legal basis, which was only finally amended in 2007. Although the uptake of LLU is increasing, it is difficult to conclude that it has been a significant success and a potential model for a transition to next generation broadband. Moreover, a recent report by European Management School & Technology[13] confirms the negative impact of the (threat of) open access regulation on Swisscom's fibre investment decisions and also on cable investment decisions as broadband margins would generally come under pressure. This would put downward pressure on the position of cable and be detrimental for future competitive dynamics.

To date, unbundling obligations are not applicable to fibre networks nor are there any legislative proposals in the pipeline to extend LLU to fibre.

Sweden

Open access regulation initially had positive effects on the emergence of new providers, with new market entrants Telenor and Tele2 benefiting most from the regulation. However, the rapid growth of broadband penetration, resulting in Sweden's top position on broadband performance, cannot be fully attributed to the existence of open access regulation. During 2002-2007, cable achieved highest growth rates in broadband with on average annual growth of 30% per year. From 2008-2009, most rapid growth was observed in Fibre/Lan connections. Significantly, this growth is being realised on unregulated platforms i.e. not subject to open access regulation like functional separation (which currently only applies to copper-based network of the incumbent TeliaSonera).
In Sweden, currently, providers with their own infrastructure serve 49% of end-consumers, compared to 35% in 2005. Of this 49%, cable, fibre and mobile take an equal 1/3 share. 22% of end-consumers are served by providers, which have some sort of wholesale construction.
In terms of next generation broadband investments, TeliaSonera is currently upgrading its network in a scattered way but is delaying large scale roll-out. TeliaSonera's investments are to the largest extent a reaction to cable's superior video (HD, VOD) and broadband offering. 89% or 1.6 million of customers of Comhem, the leading cable operator, have been upgraded to Eurodocsis 3.0. TeliaSonera invests in fibre to provide a competitive (IPTV) consumer proposition and match cable's strong 3-play offering.

Sweden is also cited as a model for large public investment playing a role in the country's fibre leadership. A more balanced assessment finds however that municipal involvement in fibre projects is today increasingly controversial, and one which can potentially disrupt market dynamics. In this light, the Swedish government has recently expressed concern about non-transparent use of state funds and the current constellation of municipal fibre projects that make it prone to distort competition. In

[13] European School of Management & Technology (2009): *'Zugangsregulierung–Auswirkung auf Investitionen in das Festnetz in der Schweiz'*

particular where municipalities own the land, the infrastructure and the housing (municipal housing companies), infrastructure competition can be undermined and consumer choice reduced. By way of example, municipal housing companies are known to have received kick-backs for every resident connecting to the municipal network, creates incentives for restricting access to buildings by alternative infrastructures.

A more balanced perspective on the Swedish market is that the current healthy competitive dynamics between multiple, strong facility-based providers is driven by a combination of open access regulation and strong infrastructure competition between incumbent and cable; In addition, it is important to note that the impact of various regulatory tools (state aid, open access, other) is highly impacted by the detailed terms of implementation.

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